Should Multiple Highway Lanes Equal Multiple TNM Roadways?

TRB Summer Session

Seattle, Washington

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Purpose of Study

To investigate the differences in results that arise when modeling a multiple lane highway with the following two scenarios:

1) One TNM roadway representing all of the highway lanes.
2) Multiple TNM roadways, each representing one highway lane.

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Modeling Procedure

- Single TNM roadway (Scenario 1)
  - Use One TNM roadway equal to the width of all lanes, with all traffic.
- Multiple TNM roadways (Scenario 2):
  - Offset roadways so edges touch each other.
  - Divide traffic:
    - Heavy trucks: middle and right lane 50/50
    - Medium trucks: middle and right lane 50/50
    - Automobiles: all lanes split evenly

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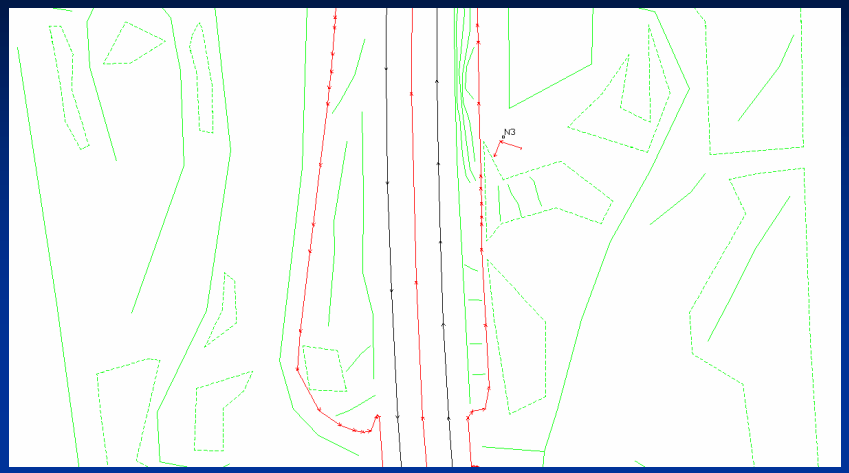
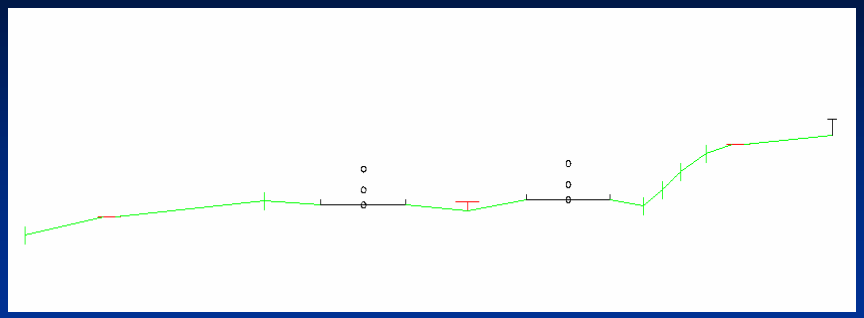
Scenario 1

Plan View: 1 - 36 ft. roadway = 3 lanes

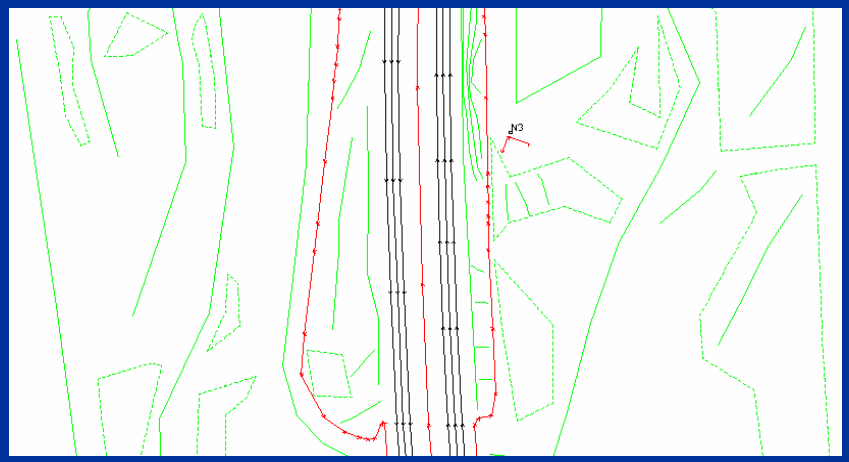


Skew View : 1 - 36 ft. roadway = 3 lanes

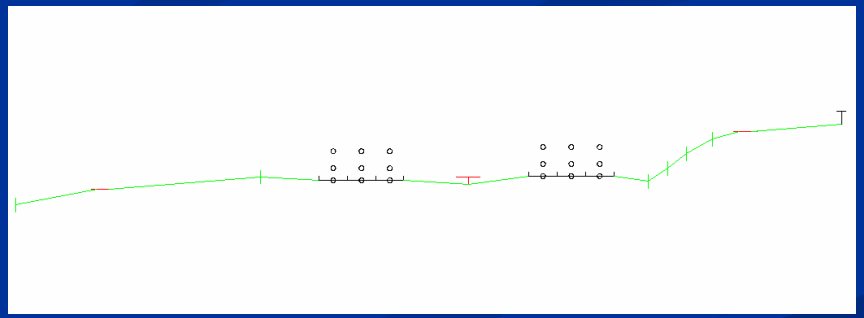


Scenario 2

Plan View : 3 – 12 ft. roadways = 3 Lanes



Skew View : 3 – 12 ft. roadways = 3 lanes



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Location Selection

- Narrow down the variables
  - Flat terrain
  - No wind during measurements
  - Average temperatures
  - No intrusion by other noise sources
  - Open line of sight to highway
  - First row receivers
- Selected Highways
  - Rosamond, Ca - State Route 14 - High desert, flat
  - Southeast New York State - I-87 - green earth, somewhat flat

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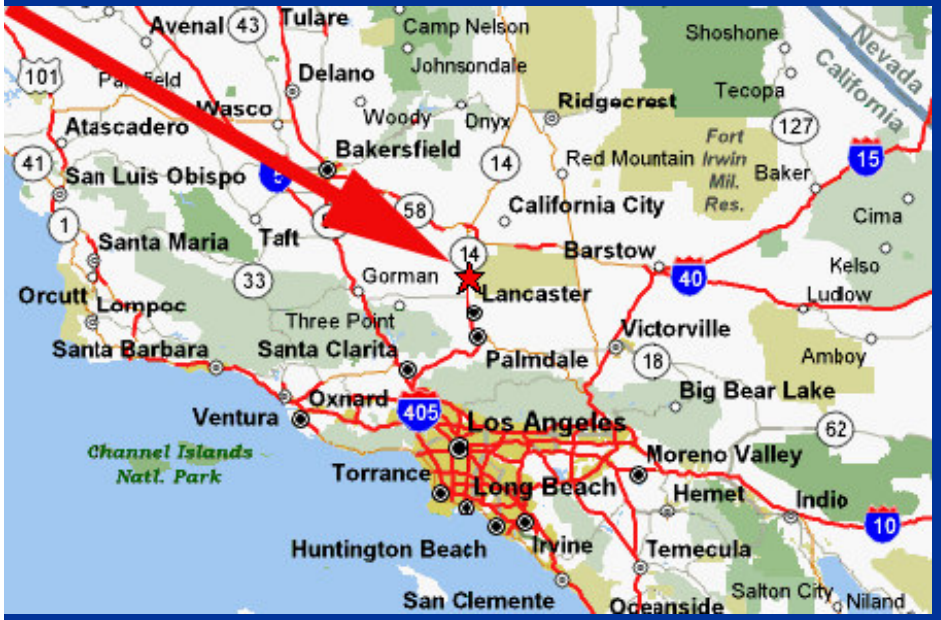
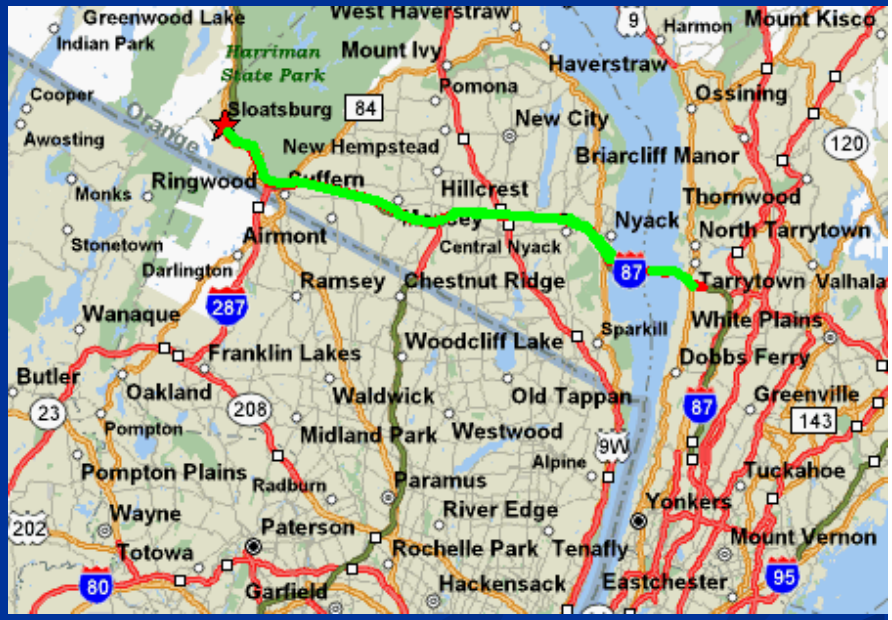
SR-14 Rosamond, CA



I-87 Southeast New York



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Locations Examined

- 7 separate study locations with field measurements
  - 2 & 3 lane highways
  - 23 total receivers
- Range of traffic volumes
  - Autos - 3554 , MT - 164 , HT - 483
  - Autos - 1033 , MT - 18 , HT - 45
- Road surfaces
  - PCC
  - DGAC

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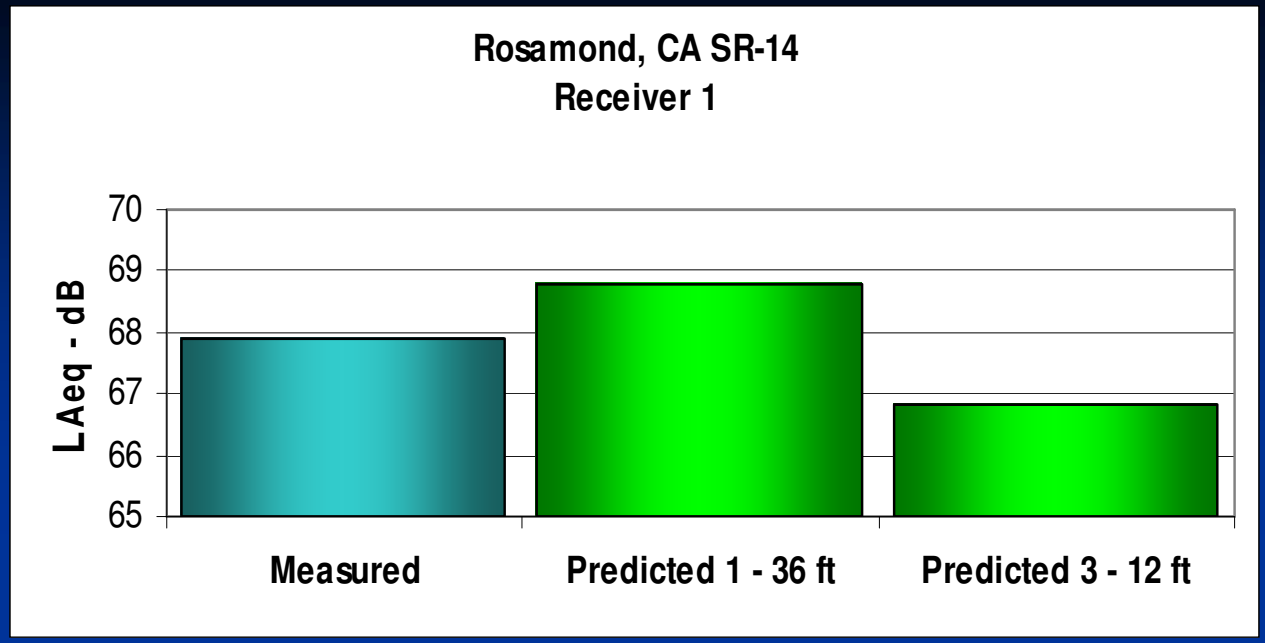
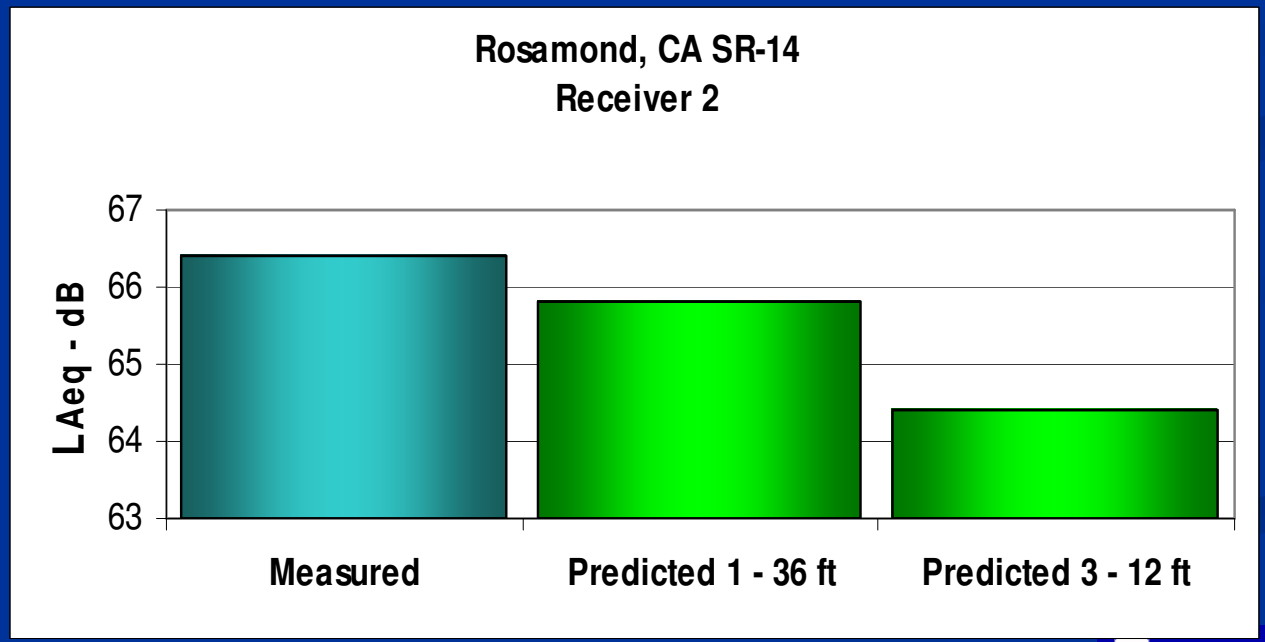

Rosamond, CA SR-14
Receiver 1
LAeq - dB
70
69
68
67
66
65
Measured
Predicted 1 - 36 ft
Predicted 3 - 12 ft


Rosamond, CA SR-14
Receiver 2
LAeq - dB
67
66
65
64
63
Measured
Predicted 1 - 36 ft
Predicted 3 - 12 ft

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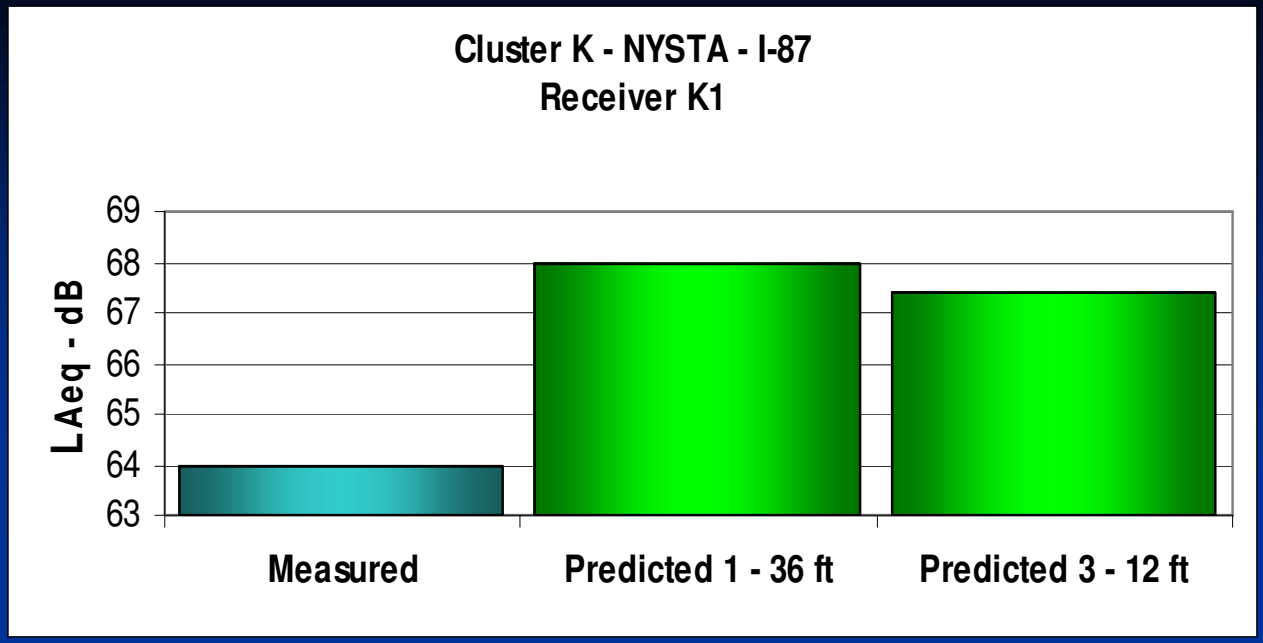
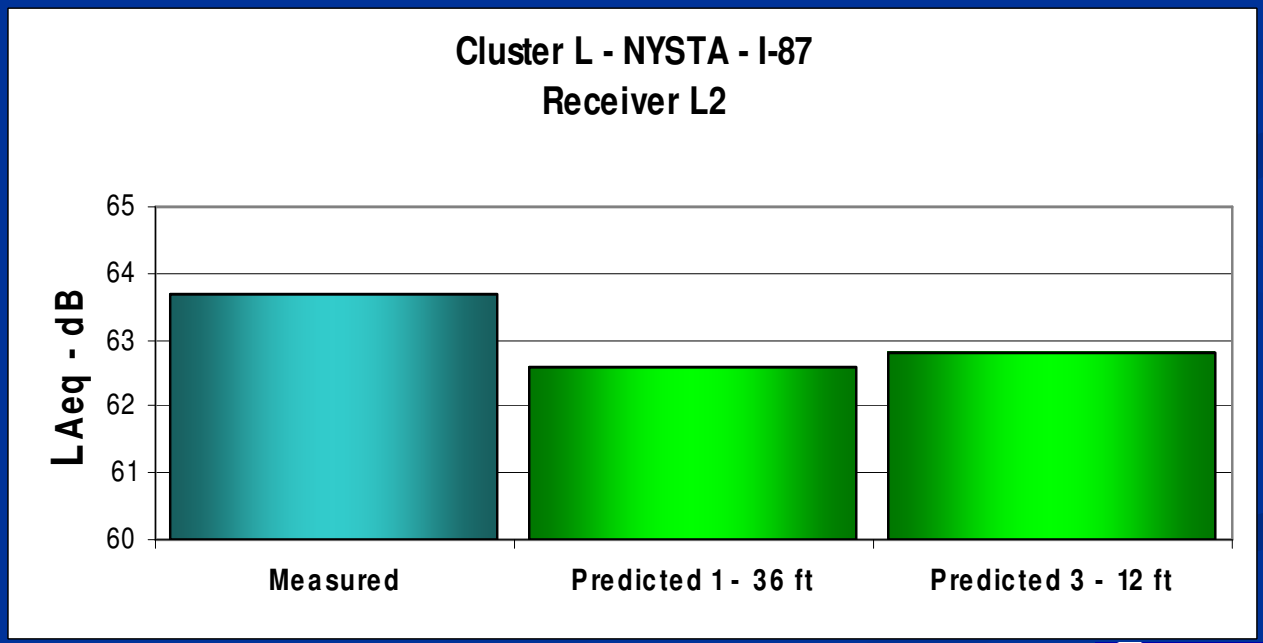

Cluster K - NYSTA - I-87
Receiver K1
LAeq - dB
69
68
67
66
65
64
63
Measured
Predicted 1 - 36 ft
Predicted 3 - 12 ft


Cluster L - NYSTA - I-87
Receiver L2
LAeq - dB
65
64
63
62
61
60
Measured
Predicted 1 - 36 ft
Predicted 3 - 12 ft

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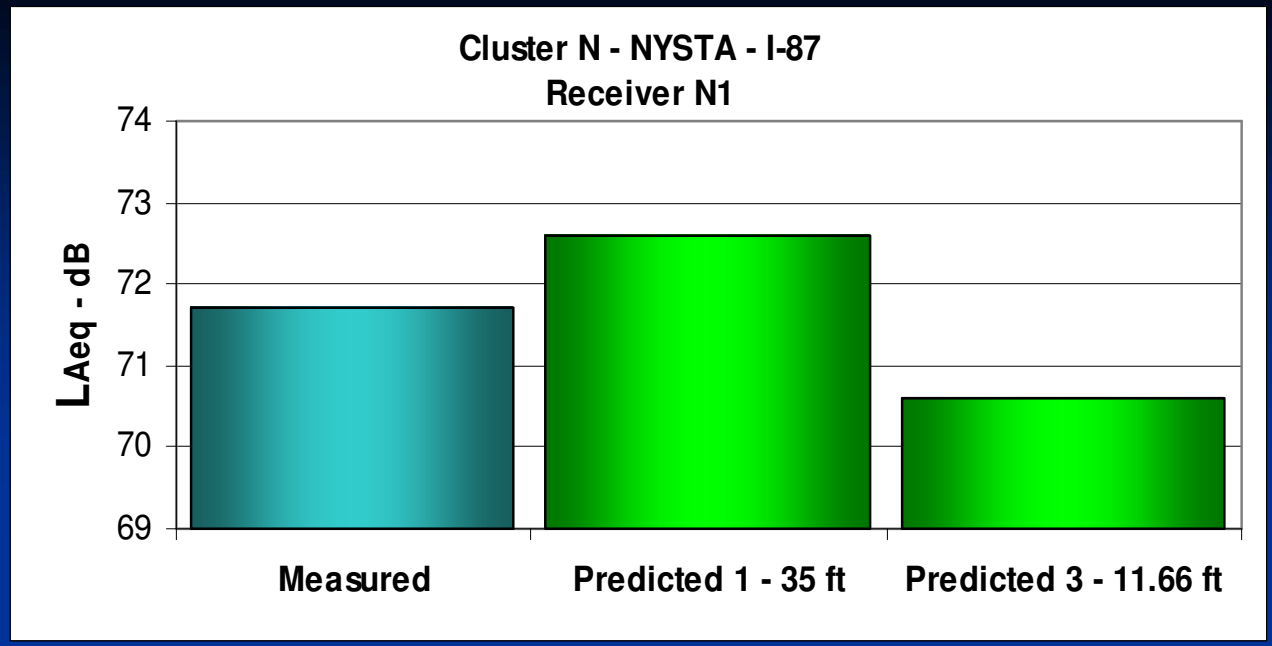
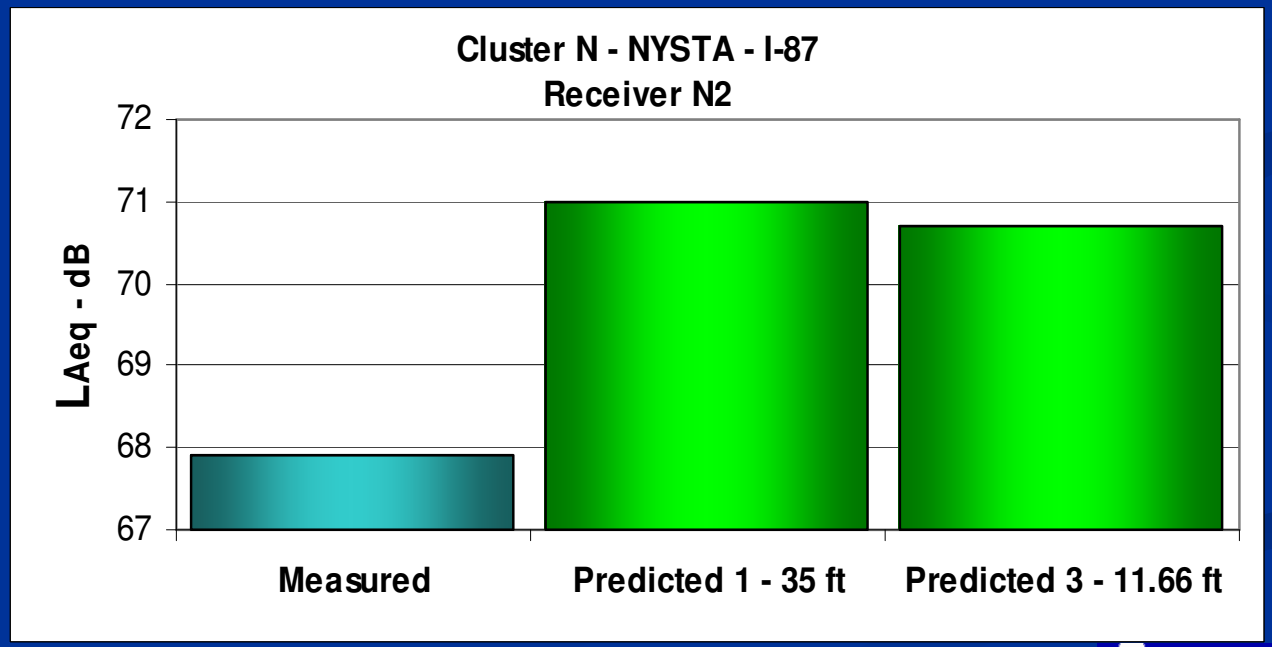

Cluster N - NYSTA - I-87
Receiver N1
LAeq - dB
74
73
72
71
70
69
Measured
Predicted 1 - 35 ft
Predicted 3 - 11.66 ft


Cluster N - NYSTA - I-87
Receiver N2
LAeq - dB
72
71
70
69
68
67
Measured
Predicted 1 - 35 ft
Predicted 3 - 11.66 ft

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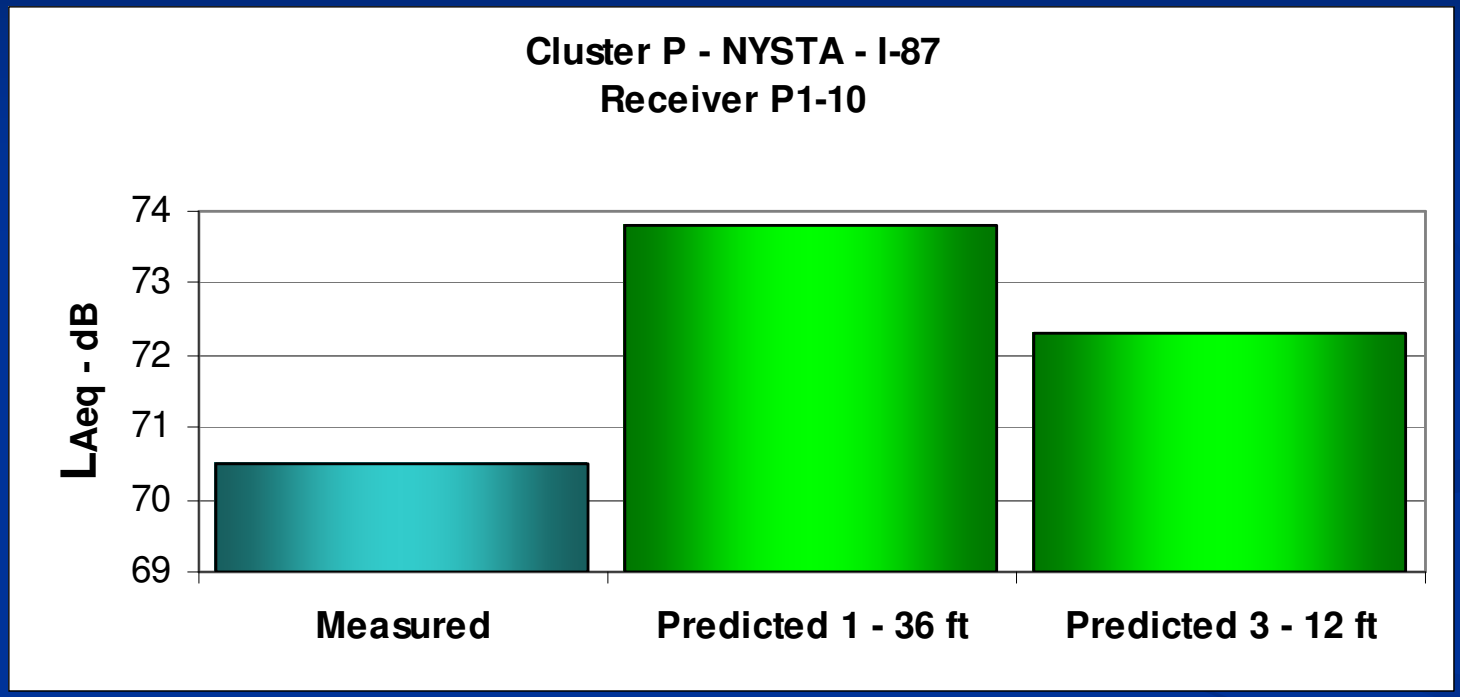
Cluster P - NYSTA - I-87
Receiver P1-10
LAeq - dB
74
73
72
71
70
69
Measured
Predicted 1 - 36 ft
Predicted 3 - 12 ft

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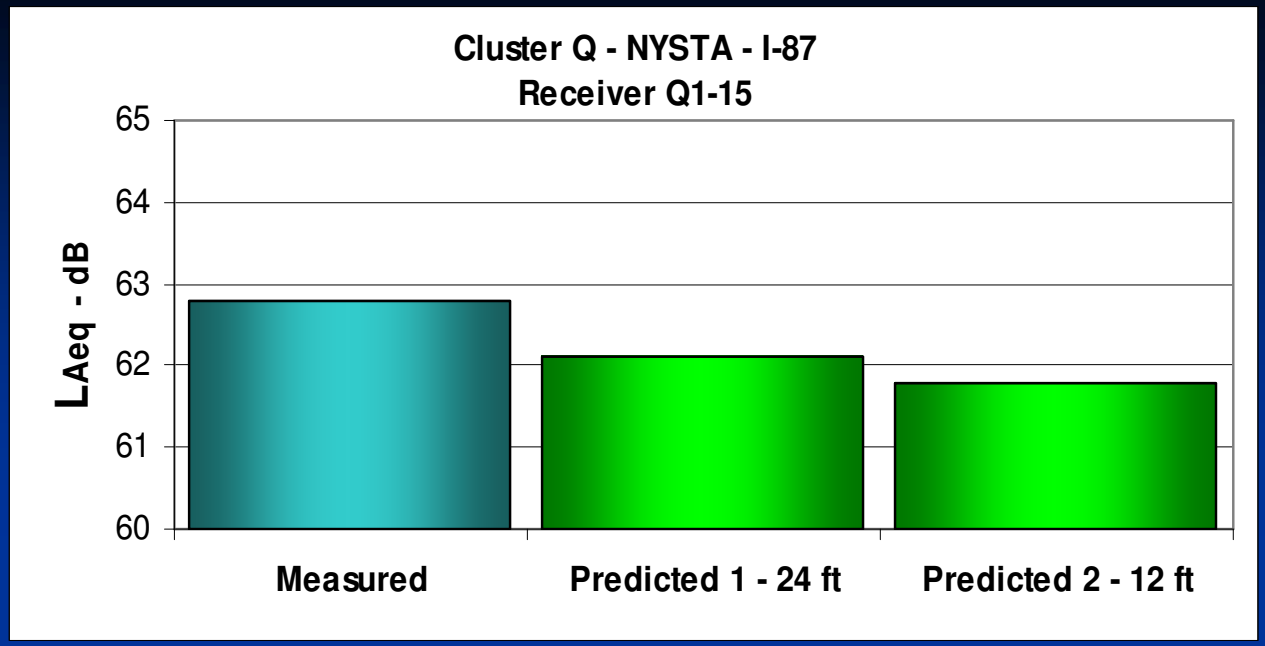
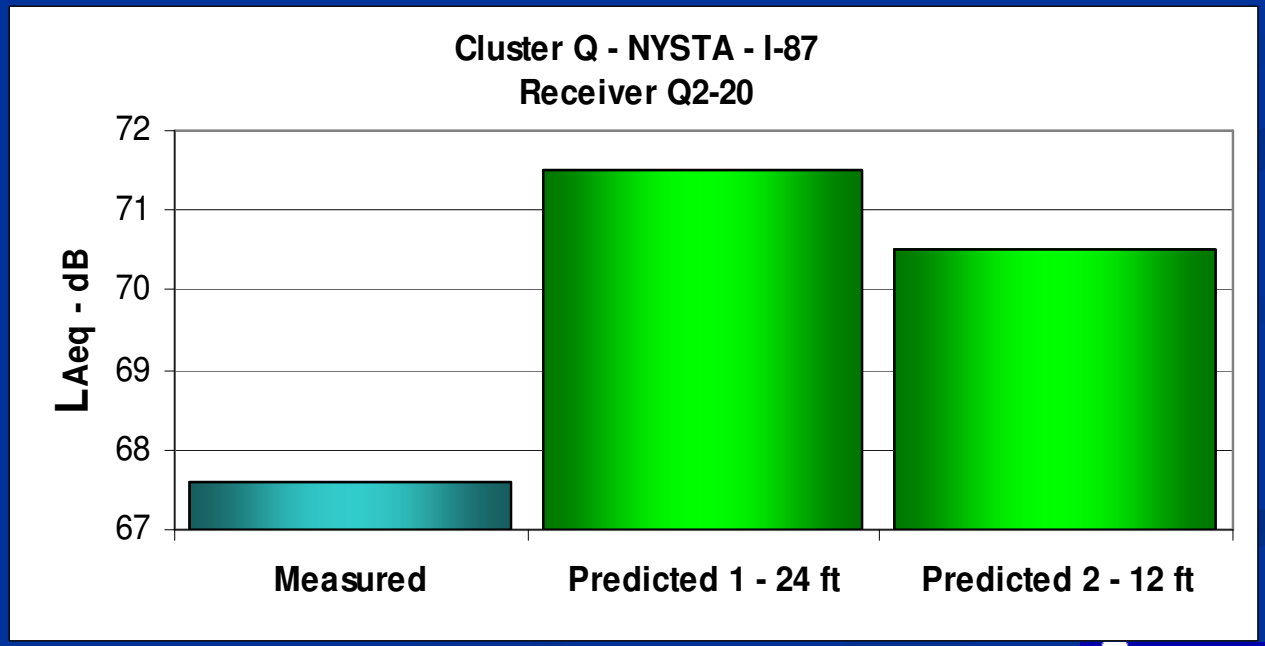

Cluster Q - NYSTA - I-87
Receiver Q1-15
LAeq - dB
65
64
63
62
61
60
Measured
Predicted 1 - 24 ft
Predicted 2 - 12 ft


Cluster Q - NYSTA - I-87
Receiver Q2-20
LAeq - dB
72
71
70
69
68
67
Measured
Predicted 1 - 24 ft
Predicted 2 - 12 ft

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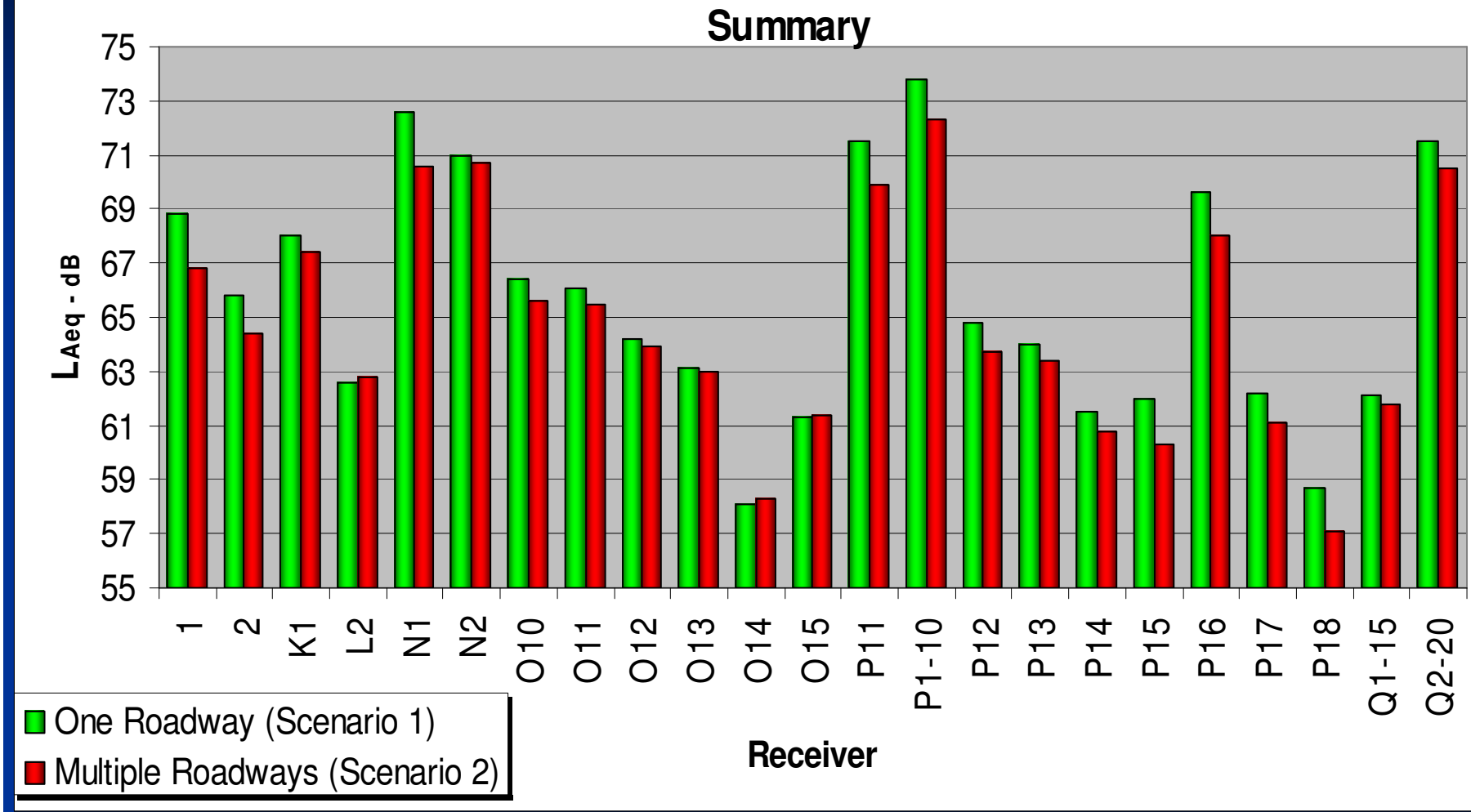
Summary
75
73
71
69
67
65
63
61
59
57
55
LAeq - dB
1
2
K1
L2
N1
N2
O10
O11
O12
O13
O14
O15
P11
P1-10
P12
P13
P14
P15
P16
P17
P18
Q1-15
Q2-20
Receiver
One Roadway (Scenario 1)
Multiple Roadways (Scenario 2)

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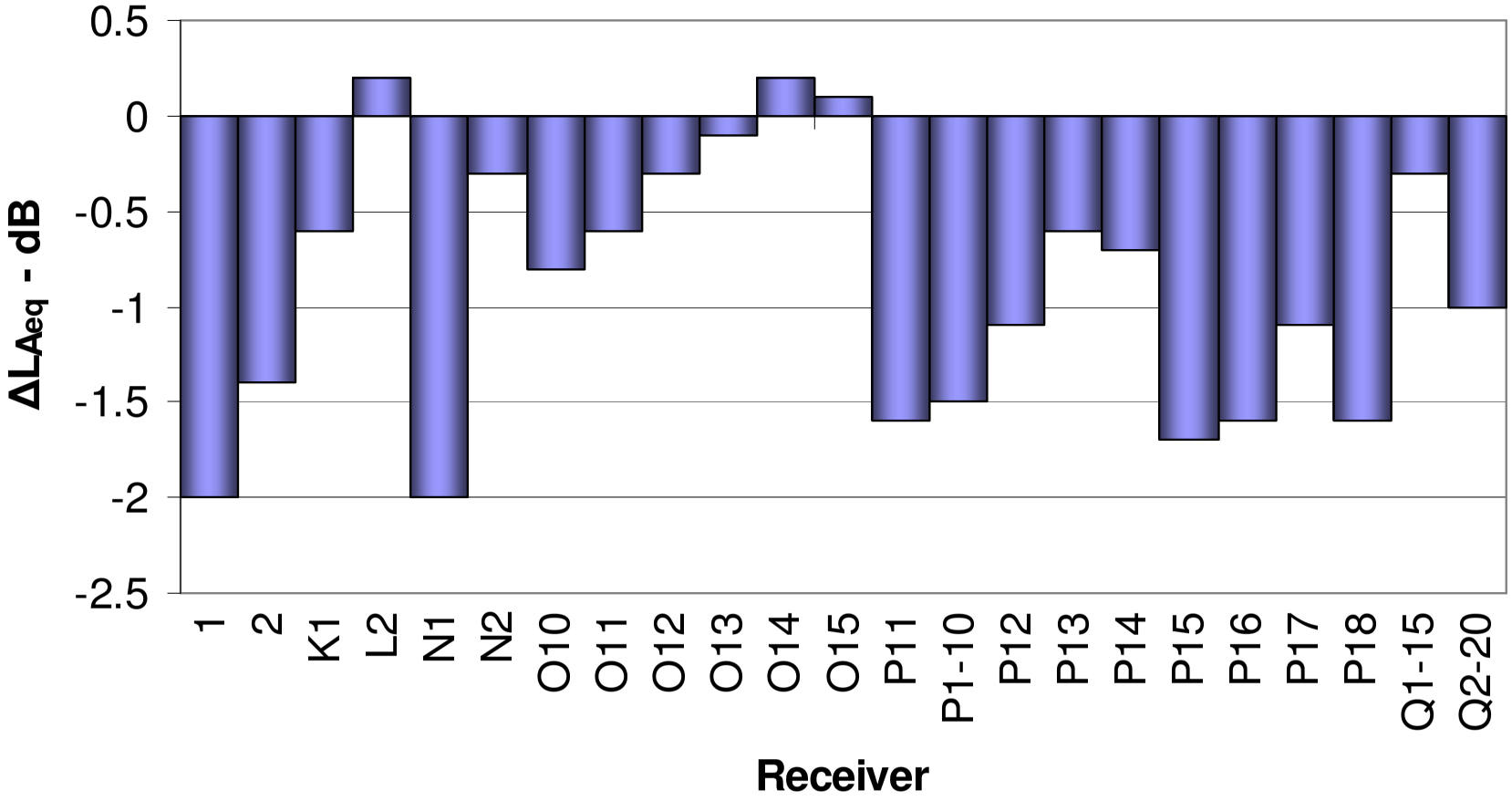
Scenario 2 minus Scenario 1



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Results

- Modeling using multiple TNM roadways (Scenario 2) results in levels that are on the average -.9 dB lower than modeling the highway with one TNM roadway (Scenario 1).

  Average (Scenario 2 – Scenario 1) = -0.9 dB

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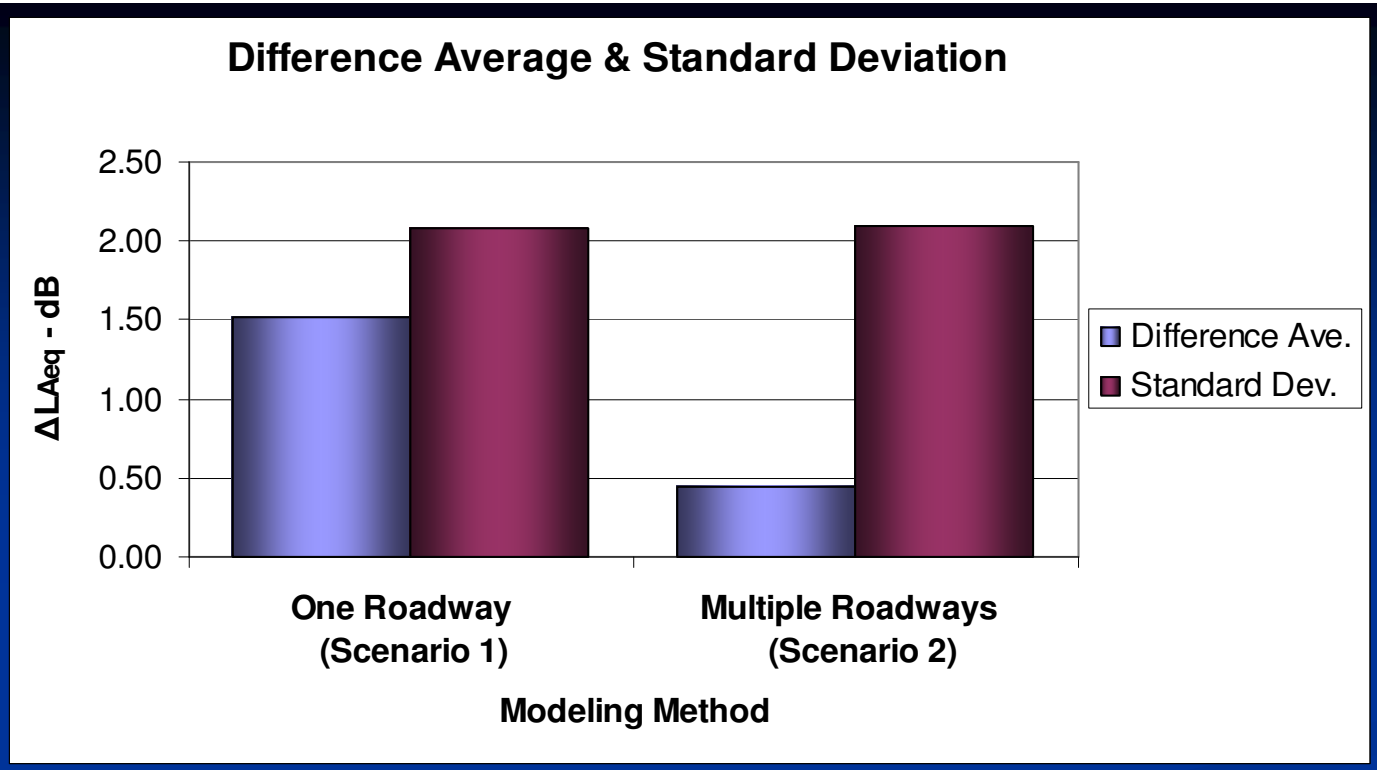

- Accuracy (modeled minus measured)
  - Scenario 1
    - Average Difference = 1.6
    - Standard Deviation = 2.1
  - Scenario 2
    - Average Difference = 0.4
    - Standard Deviation = 2.1

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Conclusion

- Scenario 1
  - Modeling highways with one TNM roadway is less time consuming. It generally calculates 1.6 dB higher than measured.
- Scenario 2
  - Modeling highways with multiple TNM roadways is more time consuming. It generally calculates 0.4 dB higher than measured.

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Thank You!

- Open discussion of why the two modeling procedures calculate different results.

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